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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/771,041	02/03/2004	Daniel K. Sodickson	B0662.70055 US00	1542
7590	06/28/2004			EXAMINER FETZNER, TIFFANY A
Steven J. Henry Wolf, Greenfield & Sacks, P.C. 600 Atlantic Avenue Boston, MA 02210			ART UNIT 2859	PAPER NUMBER

DATE MAILED: 06/28/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)
	10/771,041	SODICKSON, DANIEL K.
	Examiner	Art Unit
	Tiffany A Fetzner	2859

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) Responsive to communication(s) filed on 03 February 2004.
 2a) This action is FINAL. 2b) This action is non-final.
 3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) Claim(s) 1-39 is/are pending in the application.
 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
 5) Claim(s) _____ is/are allowed.
 6) Claim(s) 1,2,16,18,19,25,26,36 and 38 is/are rejected.
 7) Claim(s) 3-15, 17, 20-24, 27-35, 37, and 39 is/are objected to.
 8) Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) The specification is objected to by the Examiner.
 10) The drawing(s) filed on 02/03/2004 is/are: a) accepted or b) objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
 11) The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 a) All b) Some * c) None of:
 1. Certified copies of the priority documents have been received.
 2. Certified copies of the priority documents have been received in Application No. _____.
 3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|-------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ . |
| 2) <input checked="" type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____. | 6) <input type="checkbox"/> Other: _____ . |

DETAILED ACTION

Specification

1. The abstract of the disclosure is objected to because Applicant's Abstract is too long. As of March 1st 2001 all abstracts must be 150 words / 15 lines or less. A new abstract on a separate piece of paper is needed. Correction is required. See MPEP ' 608.01(b).

Drawings

2. **Figures 1, 2, 3a, 3b, 3c, 3d, 3e, 4a, 4b, 4c** of applicant's application should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP ' 608.02(g). These Figures are already present in the **Prior Art of Record**. [See US patent **6,289,232 B1** issued September 11th 2001 and the articles entitled "Smash Imaging" and "Signal-to-Noise Ratio and Signal-to-Noise Efficiency in SMASH Imaging" which are applicant's own work, and cited on page 2 of US patent **6,717,406 B2**, which is the issued patent from applicant's parent application, of the instant divisional application]. Note the figure's noted above are from the prior art but the prior art figure number are different, the difference in identification number does not overcome the examiner's objection, since applicant's **Figures 1, 2, 3a, 3b, 3c, 3d, 3e, 4a, 4b, 4c** are prior art figures.

Claim Objections

2. In **claim 1** on page 43 line 9 after "encoding functions representative" **insert "of"** and on page 47 line 16 in corresponding apparatus **claim 25** after "encoding functions representative" **insert "of"**, to avoid a grammatical error.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

4. **Claims 1, 2, 16, 18, 19, 25, 26, 36 and 38** are rejected under **35 U.S.C. 102(e)** as being anticipated by **Ehnholm et al.**, US patent 6,366,092 B1 issued April 2nd 2002, filed December 23rd 1999.

5. With respect to **Method Claim 1**, **Ehnholm et al.**, teaches “A method of forming a magnetic resonance image, comprising the steps of providing a plurality of RF receiving coils” [See figure 2; col. 3 lines 35-48; col. 6 line 58 through col. 7 line 36], “each said RF receiving coil having a different spatial sensitivity;” [See col. 3 lines 18-24; col. 5 line 59 through col. 8 line 22] “applying one or more RF pulses in combination with one or more gradient encoding steps;” [See col. 3 lines 35-45; col. 4 line 65 through col. 6 line 30] “measuring MR signals indicative of nuclear spins caused by the step of applying in the plurality of receiver coils to form a set of MR signals;” [See col. 3 lines 41-48; col. 4 line 58 through col. 8 line 26]. **Ehnholm et al.**, also teaches the steps of “generating a set of encoding functions representative a spatial distribution of receiver coil sensitivities and spatial modulations corresponding to the gradient encoding steps;” because **Ehnholm et al.**, teaches that the output signals of the coils are combined to

produce various spatial sensitivities, which include the amplitude modulation of the prior-art SMASH technique for partially replacing gradient phase encoding in the plane of the slice. [See col. 3 lines 15-29; col. 6 lines 7-48; col. 7 line 1 through col. 8 line 31] The step of “transforming the set of encoding functions to generate a new set of functions representative of distinct spatial positions in an image; and applying the new set of functions to the set of MR signals to form the magnetic resonance image” is taught by col. 6 lines 7-53; especially col. 6 lines 25-30 and 43-53].

6. With respect to **Claim 19**, **Ehnholm et al.**, teaches that the “basis functions are Gaussians” [See col. 6 lines 49-57]. The same reasons for rejection, that apply to **claims 1, 16** also apply to **claim 19** and need not be reiterated.

7. With respect to **Claim 25**, **Ehnholm et al.**, teaches and shows “An apparatus for forming a magnetic resonance image, comprising: “means for applying one or more RF pulses in combination with one or more gradient encoding magnetic fields;” [See the gradient coils x, y, z of figure 6; col. 4 line 58 through col. 6 line 6] “a plurality of RF receiving coils, each said RF receiving coil having a different spatial sensitivity and configured to measure RF signals indicative of nuclear spins of nuclei in a test subject; [See figures 2, 6, 9, 10, 11; col. 4 line 58 through col. 8 line 26, and the sensitivity calculations of col. 7 line 43 through col. 8 line 19]; and a controller, [See the additional processor in combination with digital signal processor 13 of col. 6 lines 31-48] “said controller being configured to generate a set of encoding functions representative of “a spatial distribution of receiver coil sensitivities and spatial modulations corresponding to the gradient encoding steps;” because **Ehnholm et al.**, teaches that the output signals

of the coils are combined to produce various spatial sensitivities, which include the amplitude modulation of the prior-art SMASH technique for partially replacing gradient phase encoding in the plane of the slice. [See col. 3 lines 15-29; col. 6 lines 7-48; col. 7 line 1 through col. 8 line 31] The step of “transforming the set of encoding functions to generate a new set of functions representative of distinct spatial positions in an image; and applying the new set of functions to the set of MR signals to form the magnetic resonance image” is taught by col. 6 lines 7-53; especially col. 6 lines 25-30 and 43-53]. The same reasons for rejection, that apply to **claim 1**, also apply to **claim 25** and need not be reiterated.

8. With respect to Method **Claim 2**, and corresponding apparatus **claim 26**, **Ehnholm et al.**, teaches and shows the steps and feature of “forming an encoding matrix,” where “each entry of the encoding matrix comprising a coil sensitivity of a respective coil combined with a gradient modulation corresponding to a particular gradient encoding step;” [See col. 7 line 43 through col. 8 line 19, and equations 1 through 4] “inverting the encoding matrix to form an inverted encoding matrix;” [See col. 7 line 65 through col. 8 line 19 and equation 4] “forming a k-space matrix,” (i.e. a raw data matrix as shown in equations 2-4 is a k-space matrix because a Fourier transformation has not yet been applied.) Equations 1 through equation 4 and col. 7 line 43 through col. 8 line 19 teach and show that “each entry of the k-space matrix comprising a measured RF signal indicative of nuclear spins sensed by a respective coil at a particular gradient encoding step; and multiplying the inverted encoding matrix with the k-space matrix to form the magnetic resonance image” [See also col. 6 lines 7-48].

The same reasons for rejection, that apply to **claims 1, 25** also apply to **claims 2, 26** and need not be reiterated.

9. With respect to **Claim 16, and corresponding apparatus claim 36, Ehnholm et al.**, teaches and shows the steps and feature of “forming an encoding matrix, each entry of the encoding matrix comprising a coil sensitivity of a respective coil combined with a gradient modulation corresponding to a particular gradient encoding step;” [See Equations 1 through equation 4 and col. 7 line 43 through col. 8 line 19; col. 6 lines 7-48; col. 3 lines 15-48] “fitting the entries in the encoding matrix to a set of basis functions” [See col. 6 lines 49-67] “to form transformation coefficients; forming a k-space matrix, each entry of the k-space matrix comprising a measured RF signal indicative of nuclear spins sensed by a respective coil at a particular gradient encoding step;” [See Equations 1 through equation 4 and col. 7 line 43 through col. 8 line 19; col. 6 lines 7-48; col. 3 lines 15-48] “applying the transformation coefficients to the k-space matrix to form a transformed matrix;” [See col. 6 lines 7-48, col. 7 line 43 through col. 8 line 19; equation 1-4] “and forming the magnetic resonance image from the transformed matrix.” [See col. 6 lines 7-48]. The same reasons for rejection, that apply to **claims 1, 25** also apply to **claims 16, 36** and need not be reiterated.

10. With respect to **Claim 18, and corresponding apparatus claim 38, Ehnholm et al.**, teaches that the “basis functions” may comprise “spatial harmonics”, because **Ehnholm et al.**, directly and specifically teaches that the SMASH simultaneous Acquisition of Spatial Harmonics (SMASH) by Daniel K. Sodickson from PCT publication WO-A-98/21600 can be used in combination with the **Ehnholm et al.**,

method and apparatus. [See col. 2 line 28 through col. 3 line 30; col. 6 line 28 through col. 7 line 12], "and wherein the magnetic resonance image is formed by performing a Fourier transform on the entries of the transformed matrix." [See col. 6 lines 24-48] The same reasons for rejection, that apply to **claims 1, 16** also apply to **claims 18, 38** and need not be reiterated.

Allowable Subject Matter

11. **Claims 3-15, 17, 20-24, 27-35, 37, and 39** are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Prior art made of Record

12. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

- A) **Sodickson** PCT publication WO 98/21600 published 22 May 1998, which is the foreign English equivalent of **Sodickson** US patent 5,910,728.
- B) **Jakob et al.**, US patent 6,289,232 B1 issued September 11th 2001, filed March 30th 1998.
- C) **Sodickson** US patent 5,910,728 issued June 8th 1999, filed November 12th 1996. This reference is not prior art to the claims of the instant application, because it is applicant's own earlier work, was issued less than 1 year before the filing of applicant's parent application 09/524,217 filed March 14th 2000, and does not qualify as a prior art reference under 35 USC 102 (b). It is noted only for the purposes of a complete record.

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D) **Sodickson** US patent 6,717,406 issued April 6th 2004, which is applicant's patent from the parent application 09/524,217 filed March 14th 2000. This reference is not prior art to the claims of the instant application, it is noted for the purposes of a complete record.

E) **Sodickson** US patent application publication 2002/0158632 A1 published October 31st 2002, which is the original publication of applicant's parent application 09/524,217 filed March 14th 2000. This reference is not prior art to the claims of the instant application, it is noted for the purposes of a complete record.

Conclusion

13. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tiffany Fetzner whose telephone number is: (571) 272-2241. The examiner can normally be reached on Monday-Thursday from 7:00am to 4:30pm., and on alternate Friday's from 7:00am to 3:30pm.

14. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Diego Gutierrez, can be reached at (571) 272-2245. The **only official fax phone number** for the organization where this application or proceeding is assigned is (703) 872-9306.



TAF
June 24, 2004



Diego Gutierrez
Supervisory Patent Examiner
Technology Center 2800

CHRISTOPHER W. FULTON
PRIMARY EXAMINER